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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/651,386	08/29/2000	ZHIPING YIN	11675.165.2	9675

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EXAMINER	
QUACH, TUAN N	
ART UNIT	PAPER NUMBER
2814	

DATE MAILED: 11/10/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/651,386	YIN ET AL.	
	Examin r	Art Unit	
	Tuan Quach	2814	

-- The MAILING DATE of this c mmunication app ars on the cover sheet with the correspond nc address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 October 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18 and 20-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *6-15,17,18,20-25,27,28* is/are allowed.

6)☒ Claim(s) *1-5,16, 26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *29 August 2000* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

This application presents a claim for subject matter not originally claimed or embraced in the statement of the invention. See the subject matter regarding the first and second temperature e.g., in claims 6 and as delineated above. A supplemental oath or declaration is required under 37 CFR 1.67. The new oath or declaration must properly identify the application of which it is to form a part, preferably by application number and filing date in the body of the oath or declaration. See MPEP §§ 602.01 and 602.02.

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington,* 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 1-5, 16, 26 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-46 of U.S. Patent No. 6,150,257. Although the conflicting claims are not identical, they are not patentably distinct from each other because the claimed features of the instant claims are encompassed in the claims of '257 including respective dependent claims with the instant claims are broadened in scope, e.g., electrical device instead of semiconductor

device in claims 1 and 6, heating rather than heating at less than in claim 2 versus claim 4 of '257, the passivation including chemical reaction products and solid solutions mixture in claim 10 corresponding to the passivation claimed in '257 by reacting with the chemical position, the process including titanium liner, titanium nitride and tungsten plug or metallitc structure and the passivation layer of tungsten nitride in claim 16 corrresponds to the process claimed in claim 34 of '257 wherein a first passivation and and a second passivation are shown, claim 26 regarding nitrogen-containing silane correspond to well known alternative compositions to ammonia for nitrogen source such as ammonia, diatomic nitrogen, nitrogen containing silane and the like, as admitted on page 6 lines 12-15, such selection of well known alternative materials thus would have been obvious and would have been within the purview of one skilled in the art. The features of 1 to 1000 atomic lattice layers being reacted or the thickness of less than 50 Å would have been obvious over '257, e.g., as in claims 1, 6, 9-13, 22, 32-33, 40-42, 44, etc., wherein an overlapping range of at least one monolayer to be reacted and various thicknesses not greater than 50 Å were taught.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 2, 5, 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iijima et al. taken with Hu and Hong et al.

Iijima et al. teach providing opening in insulating film 32, filling with conductive films 33/34/35, removing portions of the conductive films outside the opening to form conductive plug in the opening, annealing in nitrogen atmosphere to nitrify the surface of layer 35. As this corresponds to metal nitride material thus it would also correspond to the passivating layer. In addition, such nitridated layer thus would protect the surface of the upper surface wherein the upper surface is covered with such nitride layer thus protected thereby. The provision of upper insulating layer 37 thus adhered to the top surface thereunder is also shown. See column 7 line 63 to column 8 line 43, column 10 lines 10-14 and 29-43. An alternative process employs forming opening in insulating layer 82, depositing conductive layer 84, forming plug filling the opening, annealing in nitrogen to form layer 84b, depositing second insulating layer thereon. See column 15 lines 30-64. The limitation regarding the dielectric layer adhered to the conductive layer

and the passivation layer by chemical reaction or including chemical reactions and/or solid solutions would be met, absent evidence to the contrary, and as shown in Iijima et al. and any reaction between the dielectric and the nitriding layer would take place due the proximity of the layers. Furthermore, Hu teaches the inclusion of tungsten nitride barrier 12 on tungsten plug 14 in an insulating layer wherein the tungsten nitride can be formed by light nitridation of tungsten including the plasma nitridation, e.g., in environment containing nitrogen and plasma thereof to form effective diffusion barrier. See Fig. 1, column 2 lines 13-28, column 3 lines 5-8, column 7 line 65 to column 8 line 18. The nitride obtained thus serves as the passivating layer covering the tungsten and thus protecting the surface thereof as well. In addition to the reasons delineated in Iijima et al. above, it would have been further obvious to have effected the light nitridation of the conductive plug in Iijima et al. wherein effective barrier thereon would be obtained as suggested by Hu. It would have been conventional and would have been within the purview of one skilled in the art to have selected appropriate and suitable layer thicknesses, and conventional nitrogen containing plasma such as ammonia; claim 26 regarding nitrogen-containing silane correspond to well known alternative compositions to ammonia for nitrogen source such as ammonia, diatomic nitrogen, nitrogen containing silane and the like, as admitted on page 6 lines 12-15, such selection of well known alternative materials thus would have been obvious and would have been within the purview of one skilled in the art. Regarding the features of less than 50 Å or 1 to 1000 atomic lattice layers being reacted, such would be met by the references as delineated above, given that the nitridation is effected therein in Iijima

et al. and Hu, absent evidence to the contrary that the nitridation therein would need be over 1000 atomic lattice layers, given that the Office is not equipped to determine the number of atomic lattice layers being reacted and the thickness encompassed, and further in view of Hong et al., which teaches the provision of encapsulating diffusion barrier 34 over conductor 30 to prevent oxidation of conductor 30, wherein the layer 34 is preferably less than 10 nm for ultrathin barrier for deep submicron applications. See e.g., column 1 lines 33-35, column 4 line 43 to column 5 line 23. Accordingly, it would have been obvious to have optimized such range including selecting such thickness as taught by Hong et al. to permit the desired applications.

Claims 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iijima et al. taken with Hu and Hong et al. as applied to claims 1, 2, 5, 26 above, and further in view of Aoyama et al.

The references as applied above do not recite in-situ deposition.

Aoyama et al. teach the use of apparatus allowing the processing including plasma nitridation and interlayer insulator deposition without exposure of the wafers to the atmosphere. See Fig. 35, column 29 line 36 to column 30 line 13.

It would have been obvious and would have been within the purview of one skilled in the art to have effected the processing above including in-situ deposition of the upper insulating layer in a desired processing sequence together with or immediately following the formation of the nitride film without exposure to the atmosphere since such is conventional and advantageous to avoid interaction between the atmosphere and the previously formed film.

Claims 6-18, 20-25, 27-28 are allowed. The prior art does not show the feature regarding the step of forming the passivation comprising heating to a first temperature and thereafter to a second temperature as characterized in e.g., claim 6 the newly amended portion, claims 15 penultimate step, 24, 27 and the feature of "increamental reducing concentration of the chemical composition until it is completely removed" as in e.g., claims 10 (penultimate step), 11-14, 17, 18, 20-22, 23, 25, 28.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Hasegawa et al. and Bronner et al. are made of record.

Applicant's arguments filed October 3, 2003 have been fully considered but they are deemed moot in view of the new grounds of rejection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Quach whose telephone number is 703-308-1096. The examiner can normally be reached on M - F from 9 to 5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor Wael Fahmy can be reached on (703) 308-4918. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9318 (Before Final) and (703) 872-9319 (After Final).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

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